

Testimony before the U.S. House of Representatives
Science Subcommittee on Research
“Motorola Trailblazing the Nanotechnology Frontier”
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Chairman Inglis, Ranking Member Hooley, our homestate Illinois Congressmen Johnson and Lipinski, and members of the Subcommittee Members, good morning. I want to thank you for inviting me to share Motorola’s thoughts on where the United States stands competitively and innovatively when it comes to the subject of nanoscience and nanotechnologies.

As the Vice President for IP Incubation & Commercialization at America’s largest cell phone manufacturer, I am honored to represent Motorola’s 24,000 research scientists and engineers before this distinguished panel that time and again stands up and fights for the complex, fast-moving technology world and the ever-growing high-tech industry.

Today, as we consider the recent report by the President's Council of Advisors on Science and Technology (PCAST) on *The National Nanotechnology Initiative at Five Years*, I will use it to give you a snapshot of where we stand in relation to our global competitors. I also want to provide you some insights on how Motorola is trailblazing the nanotechnology frontier with breakthrough sciences and commercial applications.

While the National Nanotechnology Initiative (NNI) is a relatively young concept, those of us in the research and development community know the basic science for its foundation has been around for years. As the PCAST Report states: Scientists and engineers anticipate that nanotechnology will lead to “*materials and systems with dramatic new properties relevant to virtually every sector of the economy, such as medicine, telecommunications, and computers, and to areas of national interest such as Homeland Security.*”

And because of a strong commitment from the Congress and those in the Administration who understand these societal benefits, the U.S. has surged to the forefront of nanotechnology research and development – ahead of Europe, ahead of Asia, ahead of all other competing nations around the globe.

Generally speaking, this rise to prominence has been through good old American collaboration. Thanks to public-private partnerships between Federal and State governments, business and academia, our nanotechnology position has become strong. For instance, Motorola can leverage research performed in a number of our nation's esteemed universities, such as:

- U.C. Berkeley on better Nano-Tubes and Nano-Wires;
- Harvard on fabricating nonvolatile electronic memory using Nano-Tubes; and,
- Stanford on two projects: one to use synthesis technology for biological and chemical sensors and field emission devices; the other to build up a portfolio of Nano-Dots, Nano-Tubes and Nano-Wires for more enhanced electronics.

And while Motorola is still a few weeks away from officially announcing it, I am proud to inform this distinguished panel that this summer Motorola is launching the Center for Interdisciplinary Research on Nanotechnology with Arizona State University. This strong partnership between university and industry will promote nanotechnology education, research and commercialization. ASU will advance the “state of the art” in nanotechnology for communications, while Motorola will use basic and applied

technologies to develop useful and innovative products and services for American consumers –better mobile devices, equipment and high frequency applications.

But, the private-sector partnering with academia could not do it alone. We are grateful for federal support through grants as well as research and development tax credits.

The PCAST Report states: the U.S. government this year will spend just over \$1 billion on Nano R&D. To put this in perspective, \$1 billion is roughly one-quarter of the current global investment by all nations. And when you combine Federal, State and private U.S. dollars, our overall investment jumps to \$3 billion, or one-third of the estimated \$9 billion in total worldwide spending by the public and private sectors combined on Nano R&D.

To further illustrate the high-tech industry's importance to our economy in terms of jobs, research, sales, and exports, America is at the vanguard in the number of start-up companies based on nanotechnology. We also lead the world in research output as measured by patents and publications – as you can imagine, this

number-one position is very important to Motorola today and will continue to be important for our competitive growth in the future.

For example, Motorola is near commercialization on the first of its kind 5-inch color video flatscreen using Carbon Nanotube technology. This Nano Emissive Display technology, which provides much brighter and thinner flat panel displays, is now available for licensing. Motorola expects this breakthrough technique could create larger flat panel displays with superior quality, longer lifetimes and lower costs to consumers than current products in the competitive video display market.

While that's the good news, the PCAST Report highlights there are some pressing challenges that threaten our leadership position in the global economy. Specifically, the relative lead the U.S. currently holds is in jeopardy because the rest of the world is catching up in a variety of measurements. In government funding, for example, the rate of increase in the European Union and Asia is higher than that of the U.S. This should be a wake-up call for American researchers and policy-makers alike.

For instance, the EU announced this month the adoption of a Nanosciences/Nanotechnology Action Plan for Europe for 2005-

2009. Their plan proposes measures to be taken at the national and European level to strengthen research and develop useful products and services so that Europe can maintain its competitive edge in the global economy.

In the EU, much work is being leveraged through consortia efforts which promote partnering between companies and universities.

And, Japan has had over 20 years of commitment to nanotechnology through funding of broad and focused national programs. Furthermore, China now has over twice as many engineers working in nanotechnology than the U.S. does because it's been identified there, as a "government initiative."

To fully understand the zeal to get a competitive edge in the global market, let's look at Asia in general. While some of these Far East nations may not be spending as much money as the U.S. is today, they are being very strategic by choosing to concentrate their investments in particular areas in order to make significant strides sooner in a specific sector. For example, Korea and Taiwan are investing heavily in Nano-Electronics while Singapore and China are focusing on Nano-Biotechnology and Nano-Materials respectively.

Mr. Chairman, you may be wondering:

- Why is a continued Federal commitment to nanotech so important?
- Why should the American taxpayer invest so much in the global race over nano R&D?
- And maybe most importantly, what are the actual benefits of nanotechnology to American consumers?

Let me answer this way: nanotechnology research holds tremendous potential for stimulating innovation. Its revolutionary applications will enable the U.S. to maintain our global leadership in industries that span all sectors. That's as long as our public policies don't ease off the pedal of momentum or slam on the brakes on critical funding or R&D tax initiatives altogether. And don't worry, the private sector will not abandon this effort either – we're in it for the long haul.

For instance, a few large multinational companies such as IBM, Intel, DuPont and NEC have kicked off major nanotechnology efforts. My company, Motorola, continues to rebuild, retool, and consolidate our nanotechnology programs. In addition, as I mentioned earlier, the number of nano start-ups in the U.S. has

increased significantly due to heavy private sector venture capital investing.

However, I want to be candid. One of the biggest challenges before research scientists and engineers – those not necessarily known for their communication skills – is being able to relate to the American people what's actually going on in nanotech labs. This morning, I'd like to give it a shot by using a very popular Motorola product – the mobile phone.

When Motorola launched the 1st cell phone, do you remember how bulky and cumbersome it used to be?

Well, thanks to cutting-edge research utilizing nanotechnology principles at Motorola labs, tomorrow your mobile phone can have better optics, better acoustics, and better displays, more efficient batteries, and overall enriched electronics in a very small form factor.

Specifically, Nano-Composites can make today's cell phones structurally stronger, but physically smaller and lighter. Nano-Displays are larger, brighter and cost less due to embedded carbon

nanotubes, and Nano-Power can give this light-weight phone higher capacity power sources for storage and conversion.

Let me be as clear as possible: if the Internet improved our quality of life via the Information Superhighway, then nanotechnology should be considered the Express Lane for future technological breakthroughs to make our lives simpler, safer, smarter and more enjoyable. And please remember, we are simply on the cusp of much, much more to come – new advances and more challenges.

For instance, understanding the societal implications of nanotechnology -- including ethical, economic, and legal issues -- will still need to be confronted and addressed in the future, and the NNI must work harder and more consistently to better educate our fellow citizens about the wonders of nanotechnology.

And talking about education, there have been many recent reports on the shortage of American workers skilled in science and technology. The U.S. is slipping behind our competitors – Asia in particular – in undergraduate and graduate training.

At Motorola, we have found that everyday we go into the marketplace searching for highly skilled workers, demand far

outpaces supply, and this challenge seems to get worse as each month passes. It further illustrates another important component to the global competition we're witnessing in the high-tech industry. No longer is this just about a company's business demand to develop better products against Europe and Asia, but about American companies increasingly under pressure to compete against our rivals when trying to secure our basic workforce needs. Simply put, we must have a well-educated talent pool to survive.

Therefore, Motorola supports the PCAST Report's recommendation that the NNI establish relationships with the Departments of Education and Labor to develop education and training systems to improve the Nation's technical proficiency in areas related to science, technology, engineering and math – better known as the STEM fields.

In addition, immigration policies have to be set to allow, at least in the near term, U.S. trained graduates from foreign countries to stay and work here and in the longer term, a steady influx of new foreign students to come to the U.S. for their education.

On top of much-needed talent to work inside our labs, Motorola also believes there's a need for external funds to boost the physical

infrastructure to foster and maintain long-term research. I'd suggest this be a combination of direct funding and R&D tax credits to the nanotechnology labs.

As far as innovation and patenting are concerned, Motorola believes corporate investment in nanotech is very product focused. The scope of research must be longer term. In fact, long-term funding could actually enhance the speed and number of patents that are awarded and help ensure that America retains its global leadership position.

And our competitive edge isn't just about what the Federal or State government should be doing. We, as an industry, must look inside our own operations and see how we can do better. For instance, Motorola needs to take further steps to communicate with and establish links to further facilitate technology transfer from the lab to the marketplace.

As I close, the commercialization of nanotechnology does not necessarily depend upon the creation of new products – such as stain-resistant, wrinkle-free pants, or even new, emerging markets – like those more superior flat-panel displays using Carbon Nanotubes being developed by Motorola researchers as we speak.

Gains can come from incorporating nanotechnology into existing products, resulting in new and improved versions of these products. Just imagine: faster computers, lighter materials for aircraft, less invasive ways to treat cancer, and more efficient ways to store and transport electricity.

Life-changing dreams are becoming reality in our nation's nanotechnology labs. We must press forward in a coordinated, collaborative fashion between Federal and State governments, businesses in the private sector, and our academic institutions. Simply put, we must go full speed ahead on the Nanotechnology Express Lane to boost our economy and our citizens' quality of life.

Thank you for listening. I will be happy to take any questions.